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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
UMEZ ERONINI, LYNETTE T	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 03/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/619,922	JI ET AL.	
	Examiner	Art Unit	
	Lynette T. Umez-Eronini	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 December 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 17-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,17 and 18* is/are rejected.

7)☒ Claim(s) *12,13,19 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 2, 5, 6, 8, 11, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigl et al. (DD 145348 A).

Bigl teaches, "Reactive ion beam etching of Si and Si cpds. is carried out with a beam of ions or their neutralisation prods., which react reactively with the Si (cpd.).

Pref. the ions or neutral particles are obtd. from the gases CF_30F, CF_4, CF_3H, their mixts. or mixts. with O_2 or inert gas. The chemical etching rate far exceeds the sputtering rate. To influence the edge steepness of the structures produced, the

particle energy or gas compsn. is selected so that sputtering occurs as well as reactive ion beam etching.

The material to be etched is specified as poly-Si, SiO_2 or Si_3N_4. The etching rate is very high. The process is useful in semiconductor technology" (Abstract). The above reads on,

A mixture for etching a dielectric material in a layered substrate, the mixture comprising: a fluorocarbon; and a fluorine-containing oxidizer selected from the group consisting of a hypofluorite, a fluoroperoxide, a fluorotrioxide, and combinations thereof, **in claim 1**;

further comprising an inert diluent gas, **in claim 2**;

wherein the fluorocarbon is at least one selected from the group consisting of perfluorocarbon, hydrofluorocarbon, oxyhydrofluorocarbon, oxyfluorocarbon, and combinations thereof, **in claim 5**;

wherein the fluorocarbon is at least one perfluorocarbon selected from the group consisting of tetrafluoromethane, trifluoromethane, octafluorocyclobutane, octafluorocyclopentene, hexafluoro-1,3-butadiene, and combinations, **in claim 6**;

wherein the fluorocarbon is at least one hydrofluorocarbon, **in claim 8;**

wherein the fluorine-containing oxidizer is a hypofluorite having the formula $C_xH_yF_z(OF)_nO_m$ wherein x is a number ranging from 0 to 8, y is a number ranging from 0 to 17, z is a number ranging from 0 to 17, n is 1 or 2, and m is 0, 1, or 2, **in claim 11**;

wherein the dielectric material is at least one selected from the group consisting of silicon, silicon-containing compositions, silicon dioxide (SiO.sub.2), undoped silicon

glass (USG), doped silica glass, silicon and nitrogen containing materials, organosilicate glass (OSG), organofluoro-silicate glass (OFSG), low dielectric constant materials, polymeric materials, porous low dielectric constant materials, and combinations thereof, **in claim 17**; and

A mixture for etching a dielectric material in a layered substrate comprising: a fluorocarbon and a hypofluorite, **in claim 18**.

Bigl differs in failing to teach wherein a ratio by column of the fluorine-containing oxidizer to the fluorocarbon is from 0.1:1 to 20:1, **in claim 14**.

However, Bigl illustrates the specific combination of a fluorocarbon and fluorine-containing oxidizer is known. As a result, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select any proportion (% by volume) fluorocarbon in the Bigl reference that would effectively accomplish the disclosed composition because it has been held that there is no invention where the difference in proportions is not critical and was ascertained by routine experimentation because the determination of workable ranges is not considered inventive. See In re Swain and Adams, 70 USPQ 412 (CPA 1946).

4. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigl (DD 348A) as applied to claim 1 above, and further in view of Arleo et al. (US 5,176,790).

Bigl differs in failing to teach the inert diluent gas is at least one selected from the group consisting of argon, neon, xenon, helium, nitrogen, krypton, and combinations

thereof, **in claim 3** and wherein the mixture comprises from 0.1 to 99 % by volume of the inert diluent gas, **in claim 4**.

Arleo teaches etching mixtures comprising inert gases such as helium, neon, argon, krypton or xenon (column 3, lines 53-55) and may vary from 0 to 90 volume % of the total amount of gases in the mixture (column 4, lines 55-59).

Arleo illustrates inert gases are known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Bigl by selecting any of the known inert gases in the Arleo reference for the purpose of etching a via substantially without a taper (see Arleo, column 4, lines 62-64).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bigl (DD '348 A) as applied to claim 1 above, and further in view of Liu et al. (US 6,403,491 B1).

Bigl differs in failing to teach the perfluorocarbon is hexafluoro-1,3-butadiene.

Liu teaches etching a dielectric layer using hexafluoro-1,3-butadiene (claims 1 and 30) and illustrates the said perfluorocarbon is known.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Bigl by employing Liu's hexafluoro-1, 3-butadiene for the purpose making via, self aligned contacts, dual damascene, and other dielectric etch (Liu, Abstract).

6. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigl (DD 348A) as applied to claim 1 above, and further in view of Misra (US 6,242,359 B1).

Bigl differs in failing to teach wherein the fluorocarbon is at least one oxyhydrofluorocarbon, **in claim 9**; and wherein the oxyhydrofluorocarbon is at least one selected from the group consisting of perfluorocyclopentene oxide, hexafluoro-cyclobutanone, hexafluorodihydrofuran, hexafluorobutadiene epoxide, tetrafluorocyclobutanedione perfluorotetrahydrofuran (C_4F_8O), hexafluoropropylene oxide (C_3F_6O), perfluoromethylvinyl ether (C_3F_6O), and combinations thereof, **in claim 10**.

Misra teaches etching dielectric film with hexafluoropropene oxide (same as applicants' oxyhydrofluorocarbons) compounds (column 3, line 65 – column 4, line 2). Exemplary compounds useful in the etching method include, but are not limited to hexafluoropropene oxide and perfluoromethylvinyl ether or combinations thereof (column 4, lines 64 - column 5, line 20).

Misra illustrates etching with an oxyhydrofluorocarbon is known. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Bigl's etchant by using use an oxyhydrofluorocarbon as taught by Misra for the purpose of providing alternative to the conventionally used global – warming compounds for semiconductor etching processes (See Misra, column 4, lines 3-6).

Allowable Subject Matter

7. Claims 12-13 and 19-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

As to claim 12, the prior art of record taken alone or in combination fails to suggest, teach or render obvious an etching mixture wherein the fluorine-containing oxidizer is a fluoroperoxide selected from the group consisting of difluoro-peroxide, fluoro-trifluoromethyl-peroxide, bis-trifluoromethyl peroxide, pentafluoroethyl-trifluoromethyl-peroxide, bis-pentafluoroethyl-peroxide, difluorodioxirane, bis-trifluoromethyl peroxydicarbonate, fluoroformyl trifluoromethyl peroxide, bis-fluoroformyl-peroxide, and combinations thereof.

As to claim 13, the prior art of record taken alone or in combination fails to suggest, teach or render obvious an etching mixture wherein the fluorine-containing oxidizer is a fluorotrioxide selected from the group consisting of bis-trifluoromethyl-trioxide, fluoro-trifluoromethyl-trioxide, fluoroformyl trifluoromethyl-trioxide, and combinations thereof.

As to claim 19, the prior art of record taken alone or in combination fails to suggest, teach or render obvious an etching mixture comprising: a fluorocarbon and a fluoroperoxide.

As to claim 20, the prior art of record taken alone or in combination fails to suggest, teach or render obvious an etching mixture comprising: a fluorocarbon and a fluorotrioxide.

Response to Arguments

9. Applicants' arguments filed 12/27/2005 have been fully considered but they are not persuasive.

Applicants traverse the rejection of claim 1 over Bigl et al. (DD 145348 A) and the rejection of claims 14-16; 3-4; 7; and 9-10, as applied to claim 1, in view of Bigl (US '348A); Bigl (US '348 A) in view of Arleo et al. (US 5,176,790); Bigl (US '348 A) in view of Liu et al. (US 6,403,491 B1); and Bigl (US '348 A) in view of Misra (US 6,242,359 B1) as failing to teach or suggest Applicants' claimed mixture comprising a fluorocarbon and a fluorine-containing oxidizer and as not placing Applicants' claimed invention in the public's possession.

Applicants arguments are unpersuasive because Bigl discloses ions or neutral particles from CF_30F, CF_4, CF_3H gases and their mixture are used in reactive ion etching of Si_3N_4 and SiO_2 (Abstract), which reads on, Applicants' claimed mixture comprising a fluorocarbon and a fluorine-containing oxidizer.

Applicants also argue Bigl fails to teach wherein the mixture has a ratio by volume of the fluorine-containing oxidizer to the fluorocarbon form 0.1:1 to 20:1, **as recited in (Currently Amended) claim 1** and further presented arguments of

unexpected results. The arguments are not persuasive because Applicants' unexpected results are not commensurate in scope with the claims. The tables in Applicants Specification do not disclose the entire claimed ratio range and are limited to specific compound, not the general class of compounds in the claims.

Also Applicants' discovery of the claimed composition increases the etch selectivity over the use of either a fluorocarbon or, for example, CF_3OF alone (Remarks, page 8 of 11) is acknowledged. However, Applicants' discovery is unpersuasive in showing Bigl's composition failed to teach the claimed invention and failed to produce synergistic result of increasing the etch selectivity.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Art Unit 1765

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

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March 6, 2006